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FACTSHEET

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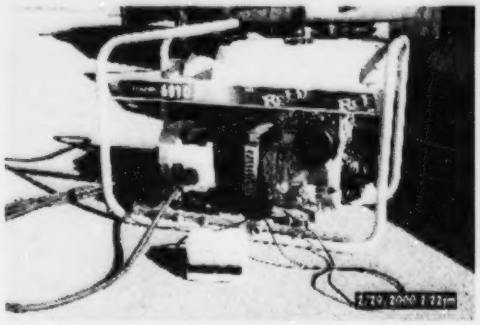
Introduction

The prolonged power outage in Eastern Ontario and Southwestern Quebec during the 1998 Ice Storm, and the concern surrounding potential power outages caused by Y2K, have combined to create significant interest in the purchase of standby generators. Farmers across Ontario have been reassessing their need for emergency electrical power supplies. This Factsheet looks at some of the factors you should think about in purchasing and operating portable generators in the 3 to 12 kilowatt (kW) size to ensure production of Quality Power. OMAFRA Factsheet *Tractor-Driven Generators: Producing Quality Power*, Order No. 00-059 provides a more detailed

review of power quality and looks at the issues surrounding the use of tractor-driven PTO generators of 15 kW and larger.

Figure 1. Portable generator with plug-in voltage frequency meter.



Portable generators are available from a number of manufacturers, in many sizes, with a whole range of features. Different terminology is often used to describe the same feature and the same terminology may describe different features. Your challenge is to understand the terms manufacturers use to describe the features of their respective units. The process is further complicated by the fact that manufacturers and retailers promote product features, while purchasers are looking for user benefits. These marketing features and user benefits all meet in a retail store where, too often, the sales person has limited knowledge to assist in translating one to the other.

Table 1, *Generator Feature/Benefit Analysis* is designed to aid in developing an understanding of the relationship between features and benefits. With this table and Table 2, *Generator Feature/Benefit Check List* on page 6, you will be able to sort through the features and determine their benefit to your operation. At the very least this Factsheet should provoke a through discussion with your supplier before you make a purchase. The decision of what features you need is a compromise or balance between price and perceived need.

This Factsheet is intended to help you select a small portable generator where the most urgent need is to run a water pump to supply water for livestock, and light and heat for the residence. Specific details for the operations of generator are available from manufacturers, distributors and electrical contractors. Always use a qualified electrical contractor when installing a generator into your electrical service.

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Table 1. Generator Feature/Benefit Analysis

Feature	Benefit
Continuous Rating is the amount of wattage the generator can supply on a continuous basis. This is where you start when you talk about the size or capacity of the generator. Check the manufacturers' specification plate for this rating. The big colourful model number on the side is probably not the continuous rating.	This is the electrical load that the generator can support on a continuous basis. Continuous means for periods of a few hours at a time, not 24 hours a day for days at a time. Generators manufactured to higher quality standards (Heavy Duty) would be expected to run for longer periods of time.

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Feature	Benefit
Maximum Rating is the amount of wattage the generator can supply for short periods of time.	This is the electrical load the generator can support for short periods of time. Short periods of time means from 2 or 3 seconds to 5 or 10 minutes every hour. Most generators restrict the extra current needed for starting electrical motors to this maximum. Ask your retailer "How much, for how long, how often?" to get a true sense of this value.

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Feature	Benefit
Surge Rating is the amount of wattage the generator can supply for a very short term, as when starting an electric motor	Most manufacturers of small portable generators do not quote or support a surge rating. Where quoted, a surge rating is typically in the range of 2 times the maximum rating for 2 to 3 seconds. A high surge rating ensures that you can start larger induction motors that have a high starting current requirement.

Feature	Benefit
Brush or Brushless Design describes the method used to transfer electric current from or to the rotating component of the generator.	There are no significant differences in performance between the 2 design types. While there may be minor advantages and disadvantage to each type this does not need to be an issue when making your purchase of an emergency use generator.

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Feature	Benefit
Voltage Regulator or Voltage Regulation addresses a feature of generators designed to regulate the output voltage being produced. Ideally, output voltage should be at or close to 120 or 240 volts. Ontario Hydro's extreme range for voltage at a rural service entrance is 212 to 254 volts. Without regulation, voltage would change as the load and/or engine speed (frequency) change.	The ability of a generator to maintain voltage in a narrow range around 120 or 240 volts is critical in situations where loads (particularly electric motors) are regularly cycled on and off. The effectiveness of voltage regulation is designed into each generator model, and varies significantly from model to model. Higher priced units generally (but not always) will have better regulation. The only meaningful way of expressing the level of voltage regulation is as a + or - percentage above or below the rated voltage. Fore example, 240 volts with a rating of ±2% would mean the voltage range would be 235.2V to 244.8V. For units without a specific plus or minus value it is not uncommon to find voltage output varying by as much as ±15% to 20%. If your usage involves significant variation in load values, or if you will be running sensitive electrical equipment, or if you plan to run the generator for significant numbers of hours, voltage regulation in the ±2% to 5% may be worth the extra cost.

Feature	Benefit
Disconnect Breaker is a breaker designed to shut off all power output from the generator.	A safety feature, designed to switch off in a short circuit or significant overload situation. Also allows power to be turned off during connection to or disconnect from load. Not all portable generators have this feature. In direct hookups to electrical sub-panels this is the preferred system.

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Feature	Benefit
Circuit Breakers have the same function on a generator as in the regular electrical panel in your house. Generally each circuit or plug has its own circuit breaker.	Automatically trips if there is a short circuit or an overload, preventing damage to the generator or electrical equipment connected to circuit. Some generators have a main disconnect breaker as well as protection for each circuit. This combination gives the greatest protection for generator and personal safety. No fuses to replace.

Feature	Benefit
Non-fuse Breaker is another name for Circuit or Disconnect Breakers	No fuses to replace

Feature	Benefit
Plug Type or Number is the CSA number of the plug required to match the receptacle on the generator. There are 3 types of plugs with numerous capacity ratings commonly used on portable generators. Current CSA regulations require a 4 prong twist-lock plug for hard-wiring into residence sub-panel.	The plug number and its matching receptacle number are identification numbers accepted as industry standards. This insures only proper capacity plugs are used. For example, a 125/250V 20amp receptacle would need an L14-20R plug. The CSA number is engraved into the plug and the receptacle for proper identification.

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Feature	Benefit
Full Capacity Outlet describes a receptacle, and its matching plug, which is design to handle the maximum capacity of the generator. Usually rated by amperage. The relationship between current, voltage and wattage is shown as: Current (in amps) x Voltage (in volts) = Wattage (watts) Therefore, a 20 amp, 240 volt plug would be a full capacity plug for a 4800 watt or smaller generator (20 amps x 240 volts = 4800 watts)	Whether this is an important feature depends on how you plan to use the generator. If you will be plugging individual loads into each receptacle then a full capacity plug is not an issue provided you do not exceed the capacity of each plug and that the total of all loads do not exceed the capacity of the generator. However, if the generator is to be connected directly to a sub panel or transfer switch and the owner wishes to use the full available power from one receptacle, then a full capacity outlet is needed.

Feature	Benefit
Circuit Selector Switch allows directing full rated power to the outlet, which is used for direct hookup through a transfer switch connection.	Flexibility in using power output from generator while guarding against over loading. Only certain receptacles can be used at any one time.

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Feature	Benefit
Ground Fault Ccircuit Interrupter cuts off electricity if some of the current tries to return to ground by a method other than the neutral wire (a fault). It does this by measuring current in the live wire and comparing it to the neutral wire; when these 2 measurements are different; power is disconnected from the receptacle.	Protects against the hazards of grounding faults from defective tools, or cords. If the ground wire does not make a perfect contact to the ground, the leakage current will flow through the operator to the ground. Of particular importance when working in damp areas or conditions.

Feature	Benefit
Voltmeter - a meter which measurers voltage. Can be built into the generator or purchased as a hand held unit.	Ensures that the voltage produced is within acceptable range. See VOLTAGE REGULATION for acceptable voltage range. Electrical equipment can be damaged by voltage too high or too low.

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Feature	Benefit
Frequency Meter - a meter for measuring frequency of alternating current. In North America electricity is delivered at 60 cycles per second (60 Hertz or Hz).	Frequency is directly tied to engine speed. By ensuring that frequency is at or close to 60 Hz, (between 58 and 62) the correct engine RPM can be maintained for optimum voltage output.

Feature	Benefit
Insulation Class identifies maximum allowable operating temperature.	Insulation class is a coding for generators and electric motors identifying the maximum allowable operating temperature of the windings. The higher the class, the higher allowable temperature. Class A, B, F and H are the most common classes encountered with maximum operating temperatures of 105°C, 130°C, 155°C and 180°C respectively. Generators and engines produce considerable heat, and units built to higher insulation ratings will usually carry a premium price. Ventilate properly to stay within the proper operating temperature.

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Feature	Benefit
Oil Alert is a device designed to shut down the engine when the crankcase oil drops below a safe level. Some systems use a float in the engine crankcase to sense the oil level. If the oil falls below a certain level during operation, the float signals the engine to shut down. The indicator light blinks on and off to indicate low oil. Another type uses a sensor in a pressurized engine oil system. If the oil pressure falls below the preset value during operation, the engine ignition is grounded out and the engine shuts down. A time delay allows for low pressure during engine starting. If the oil system doesn't build sufficient pressure quickly enough to close the oil sensor switch, the engine will not continue to run.	This will help prevent engine damage from low oil situations. The oil pressure sensor system is a much more robust and accurate system. The float system can be affected by cold weather operation, cold oil does not flow as freely as warm oil and float may give erroneous shut down readings. If your intended use involves long periods of unattended running of the generator this may be a worthwhile feature.

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Feature	Benefit
Automatic Idle Control reduces engine speed when all electrical loads have been turned off and automatically returns to rated speed when loads are turned back on	Reduces fuel consumption. While generally viewed as a good feature, this is not always true. Delays in responding to load demands, particularly during electric motor start up, could lead to premature motor failures. On units with poor voltage regulation: as the engine speed drops, voltage levels may fall below 100 volts from a 240-volt output. If electronic controls or components are still being powered (thermostats, clocks, etc.) but are not drawing enough power to trigger idle control off, damage may occur. If your generator has this feature, review usage and monitor voltage carefully before activating it.

Feature	Benefit
Splash Lubrication - lubrication system where the rotating engine parts splashes and throws oil around the inside of the engine for lubrication.	Economical.

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Feature	Benefit
Pressure Lubrication - lubrication system where an oil pump forces oil throughout the engine.	Longer engine life. Increased cost

Feature	Benefit
Automatic Decompression - a feature that reduces the amount of compression in the engine cylinder during start-up. Returns to normal compression after engine starts.	Decompression makes it easier to pull the starter rope. This is most beneficial for engines with higher horsepower ratings (8 hp and over).

Feature	Benefit
Governor Type - describes the type of governor used to control the speed of the engine as electrical load changes. An **air-governor** uses the amount of air flow produced by the flywheel to change the throttle setting. If the engine slows down because of an increased load, the reduced air flow allows the throttle to open to speed up the engine. An increase in speed produces more air flow that closes the throttle. A **mechanical-governor** uses a set of weights to control speed. The faster the weights spin the further out they are flung shutting down the throttle. When the speed drops the weights return closer to their turning axis and the throttle opens.	Maintaining the correct engine speed (3600 RPM) is required to generate electrical power at 60 Hertz. The correct speed is required to insure the proper voltage levels. The governor of an engine is the device that keeps the speed at or near 3600 RPM. The more sensitive the governor is to changes in speed as loads change the closer frequency will stay to 60 Hz. Mechanical-governors tend to be more effective at maintaining the required engine speed.

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Feature	Benefit
OHV - overhead valve engine. The intake and exhaust valves are located, over the cylinder, in a separate component of the engine called the head.	An engine with OHV is generally considered to be of better quality than units with the valves in the block. Benefits include improved combustion efficiency, reduces fuel and oil consumption, and the increased ability to rebuild engines for longer life.

Feature	Benefit
Cast Iron Cylinder(s) - describes the material used in constructing the cylinders of the engine.	Engines with cast iron cylinders generally give longer engine life, and are often considered better quality than aluminum.

Feature	Benefit
Fuel Tank Capacity indicates how much fuel the tank holds.	A large capacity tank allows the generator to run longer without refueling.

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Feature	Benefit
Run Time at Specified Load is an estimate of the amount of time the generator will run with a specific percentage of rated load. i.e.: 8 hours @ 50% load.	This specification gives the operator some indication of how long the generator will run at the specified load. Use this as an estimate only.

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Table 2. Generator Feature/Benefit Check List

	1st Unit	2nd Unit	3rd Unit	Comments
Continuous Rating				
Maximum Rating				
Surge Rating				
Brush or Brushless				
Voltage Regulation				
Disconnect Breaker				
Breaker Type				
Plug Type				
Full Capacity Receptacle				
Circuit Selector Switch				
Ground Fault Interrupter				
Voltmeter				
Frequency Meter				
Insulation Class				
Oil Alert (shut down)				
Automatic Idle Control				
Engine Lubrication Method				
Decompression Starting				
Governor type				
Overhead Valve Engine				
Cast Iron Cylinder				
Fuel tank Capacity				
Run Time				
Warranty/Location				
Parts & Service Location				
Price				

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The information in this Factsheet has been condensed from several sources, including operator manuals, generator testing, and interviews with generator manufacturers. It is not intended as a substitute for professional advise from a manufacturer or supplier of generators. Always consult your electrical contractor. All installations of electrical equipment are subject to inspection requirements contained in the Ontario Electrical Safety Code.

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